

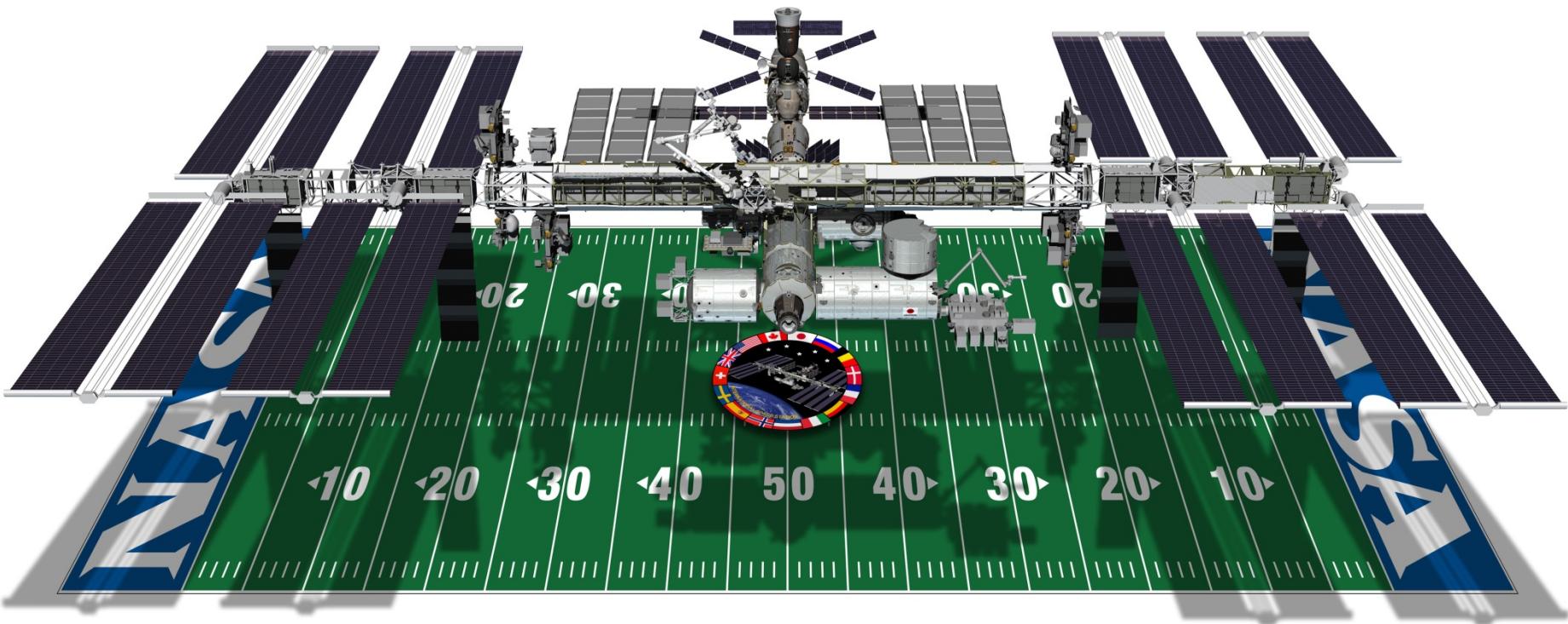


Inventive Tricks and Fixes Aboard the ISS

# MacGyvering Station

# International Space Station

National Aeronautics and Space Administration

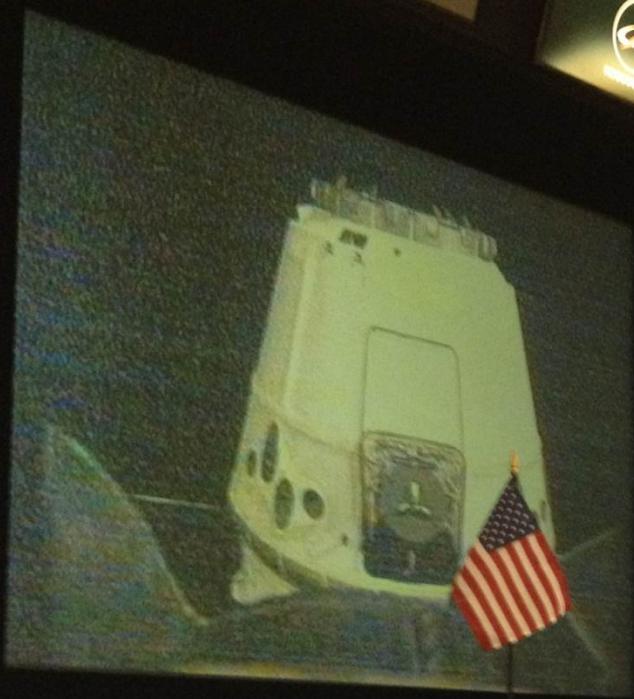




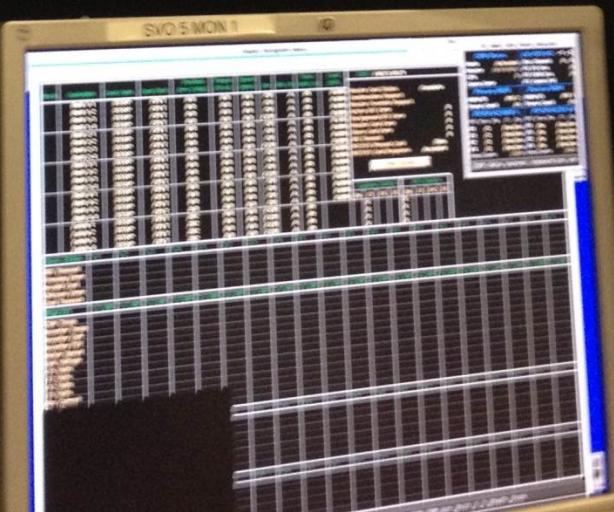
DAY  
CLOUDS MET  
U.S. MET (44°)  
34.13.45.31  
40.00.00.00  
Crew Sleep



Mission Control Center  
Houston TX



CSL 234N FL 405





# The Challenge



#THEMARTIAN

# The Plan Never Survives...

- We've done a lot things that weren't planned to be done on board...
  - Upgrading computer processors
  - Removing a filter from a pump that didn't need one, and adding a filter to a different pump that needed one
  - Creating sleeping quarters until the real ones arrived
- But some fixes were more inventive than others...



ISS01E6264 2000/12/16 16:29:56



ISS01E6262 2000/12/16 16:18:30



## Collections

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### Objects

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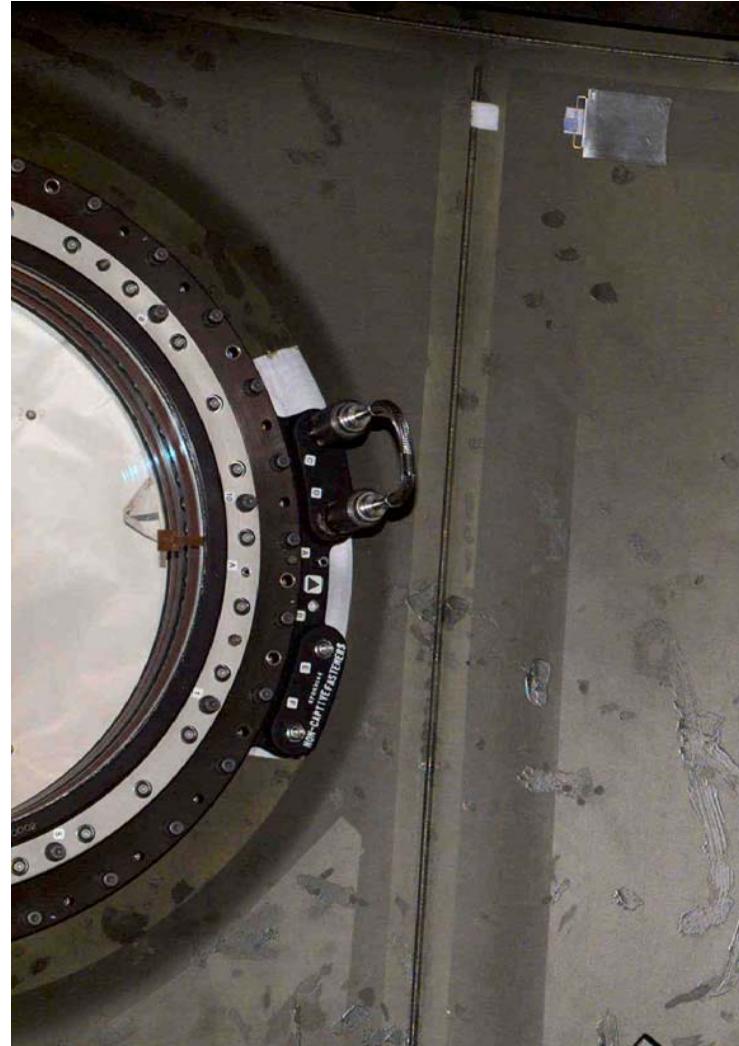
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## Table, International Space Station (ISS)



# The Window Box (2004 / Inc 9)

- **Problem:** crew uses a hose to space as a handhold to look out the window.
- **Impact:** station leaks too much.
- **Workaround:** build a box around the hose.  
Originally it was to be built from on-orbit supplies, but eventually a kit to build the box was flown.

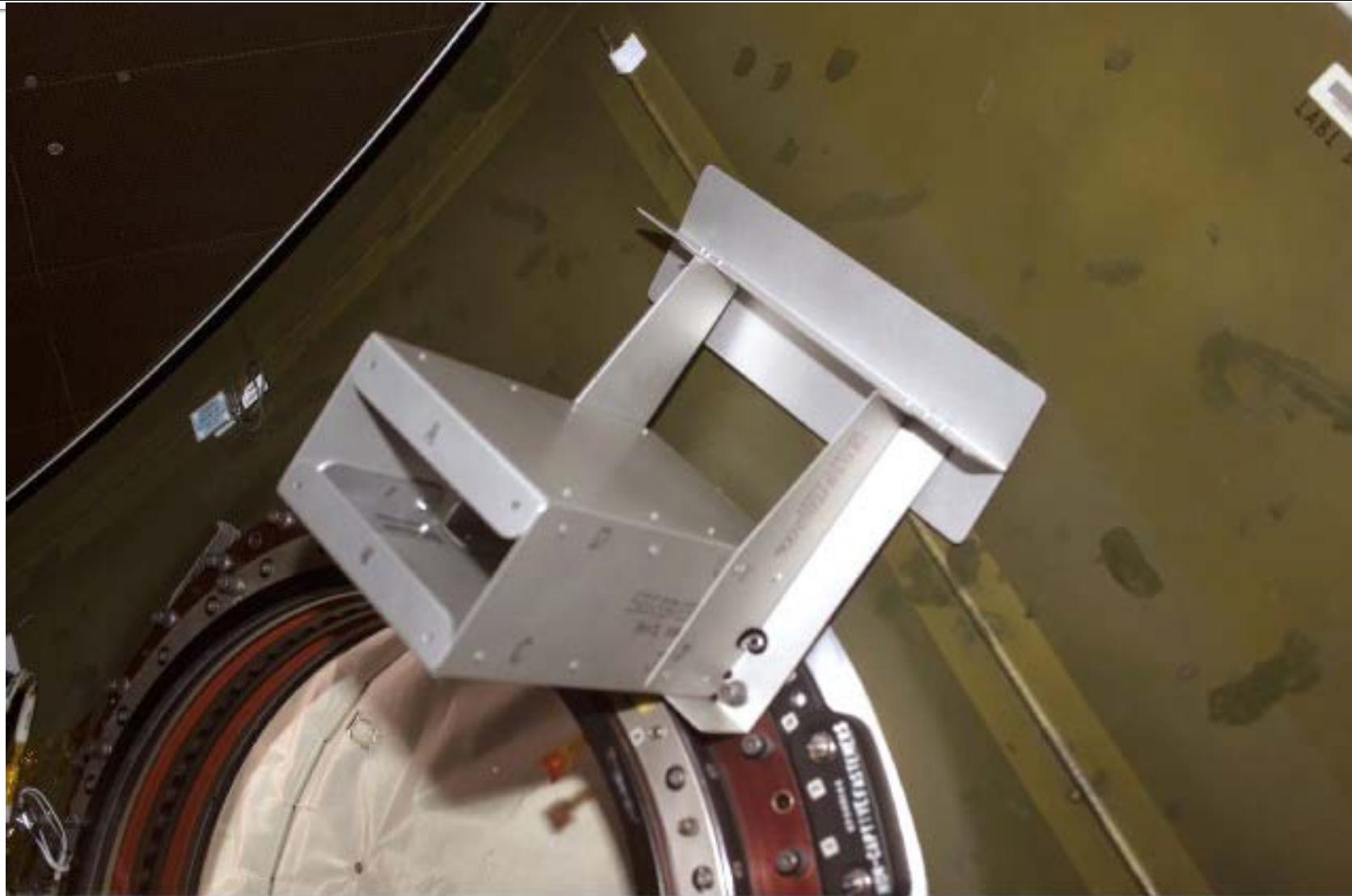


# Window Box Parts List

Table 1 - Lab Window Flex Hose Cover Kit contents

Item #	Part Name	Quantity
1	Top Plate	1
2	Bottom Plate	1
3	Right Plate	1
4	Left Plate	1
5	Front Plate	1
6	Right Bracket	1
7	Left Bracket	1
8	Attachment Bracket, 74°	1
9	Attachment Bracket, 100°	1
10	Angle Bracket (M&C)	1
11	Angle Bracket (K&J)	1
12	Angle Bracket (L&R)	1
13	Angle Bracket (N&P)	1
14	Angle Bracket (E&D)	1
15	Angle Bracket (H&U)	1
16	Angle Bracket (F&O)	1
17	Angle Bracket (G&Q)	1
18	Velcro Loop, 11.0 x 1.0	2
19	1/8" Dia. Pop Rivet, 1/4" Length	60 rivets
20	Lab Window Bolt	2
21	Lab Window Washer	2
22	Keep Out Zone Decal	1

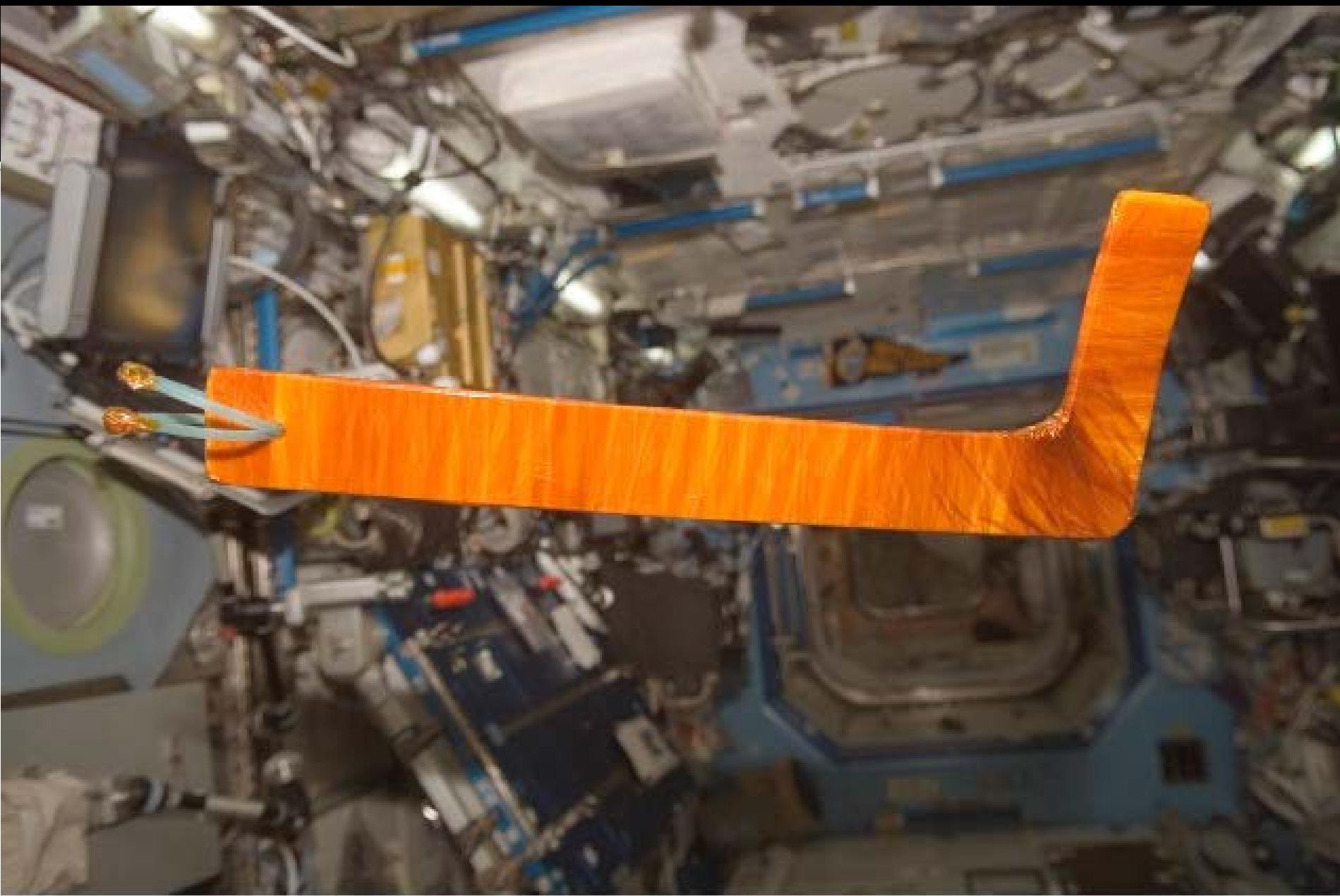
# The Window Box



ISS009E17278

# A Balky Tool: Percussive Maintenance





ISS015E08376

# Solar Array Hockey Stick - In Use



# Solar Array Cufflinks Parts List

## MATERIALS:

- Sharpie
- Ziplock Bag (two)
- Kapton Tape
- EVA Tape
- ISS Pin Kit: (two)
- Page 3
  - 12 Ga Wire (50 feet) (need approximately 66 feet total)
- Clamp and Bracket Kit:
  - 0.03" x 4" x 12" Aluminum (two)
- Large Gauge Pin Kit:
  - Small Split Bolt Connector P/N S-4

## TOOLS:

- Eye Protection
- DCS 760 Camera
- ISS Vacuum Cleaner
- MWA Utility Kit:
  - Track Restraint (two)
  - PC Circuit Board Clamp (two)
- Clamp and Bracket Kit:
  - Tin Snips
  - Hand Punch
  - Hand Punch Key

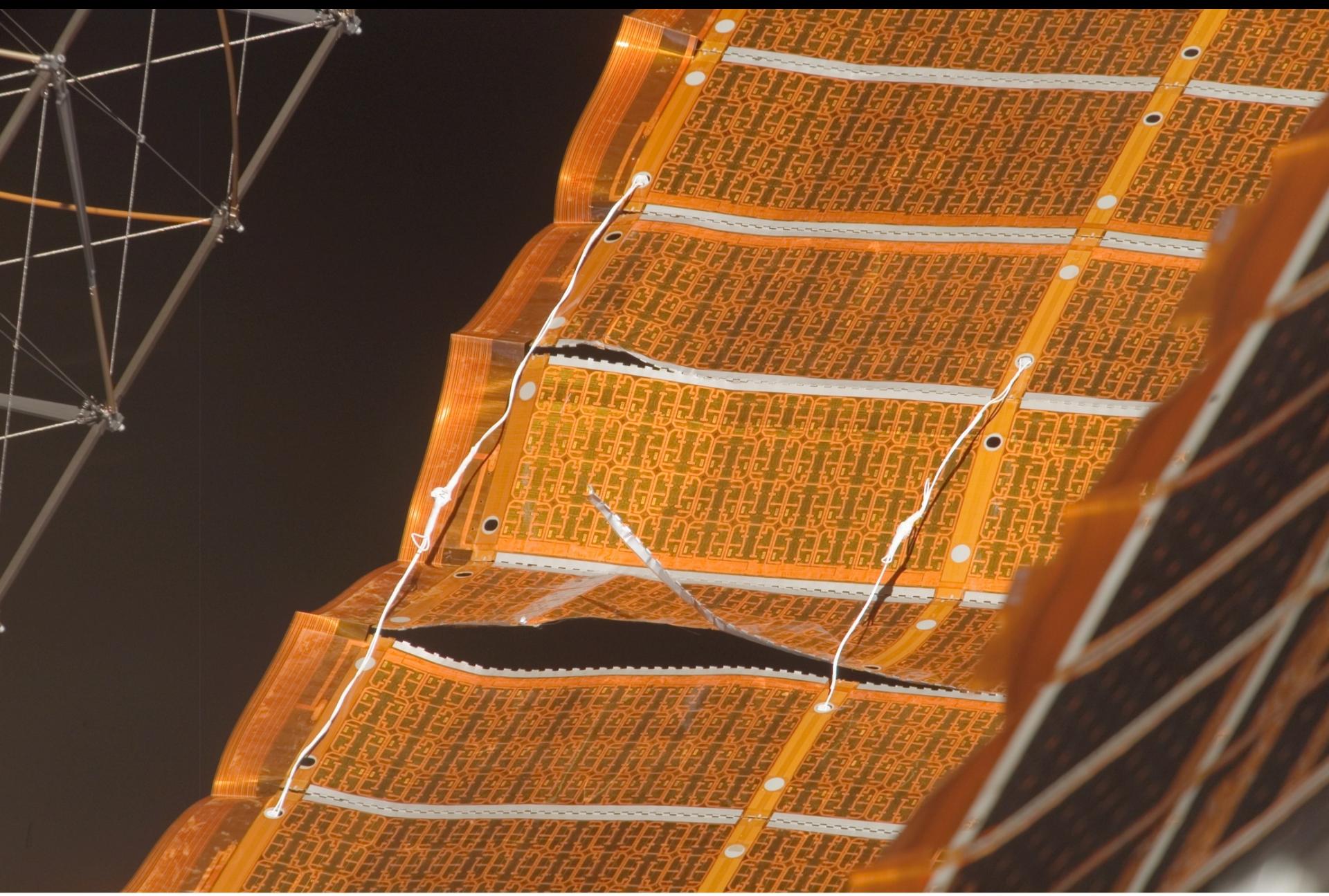
- 9/32" Punch Insert (engraved "281")
- 9/32" Punch Die (engraved "281")

## ISS IVA Toolbox:

- Drawer 2:
  - 9/16" Socket, 3/8" Drive
  - 11/16" Socket, 3/8" Drive
  - Ratchet, 3/8" Drive
  - (40-200 in-lbs) Trq Wrench, 3/8" Drive
- Drawer 4:
  - Wire Cutters
- Drawer 5:
  - Tape Measure
  - Steel Rule
  - Breaker Bar, 3/8" Drive
  - File Set, Small
  - Small Round File
  - Red File Handle
  - File Set, Large
  - Large Hand File
  - Black File Handle

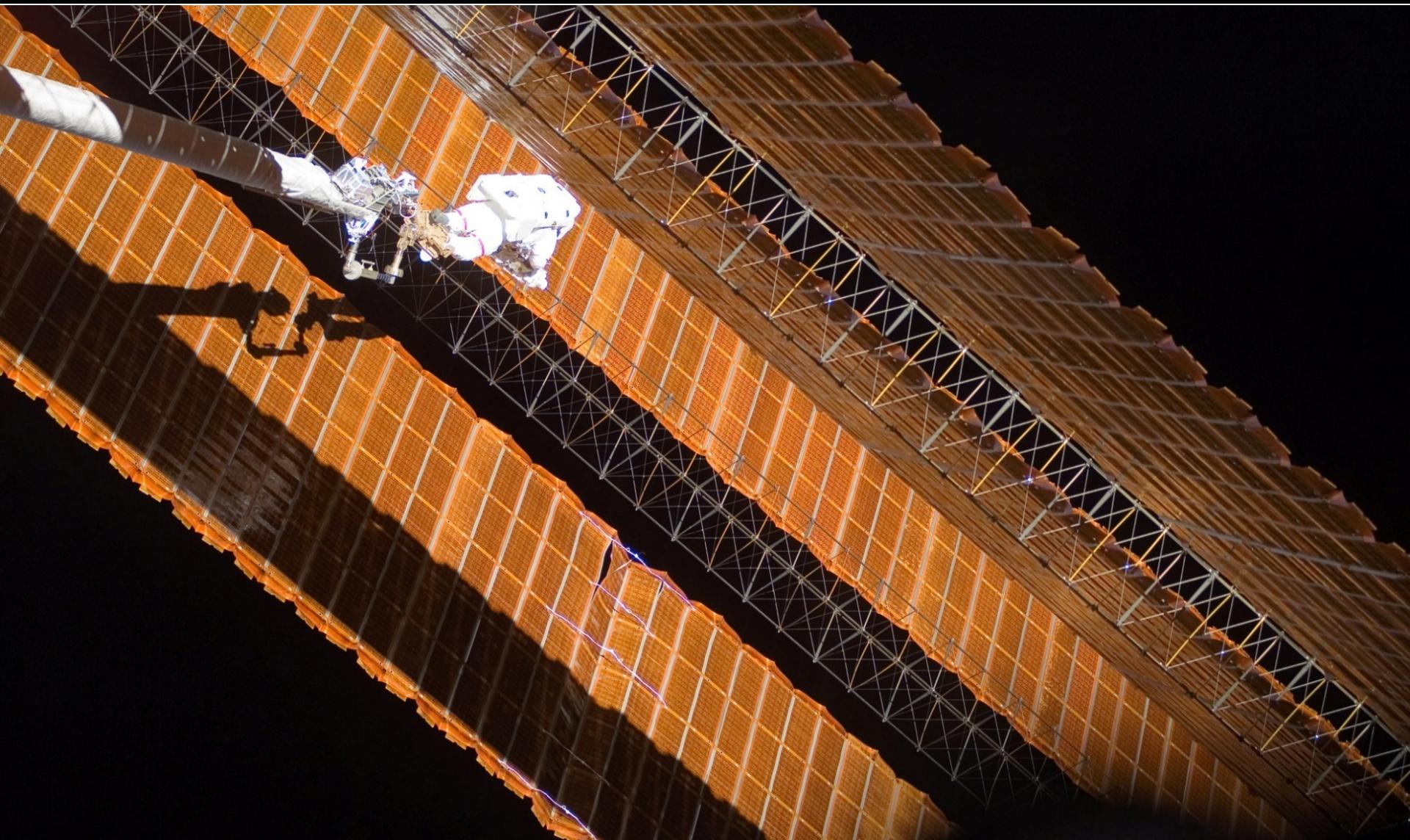
# Solar Array Hinge Stabilizers ... a.k.a. Cufflinks





ISS016E008875

# Solar Array Seamstress



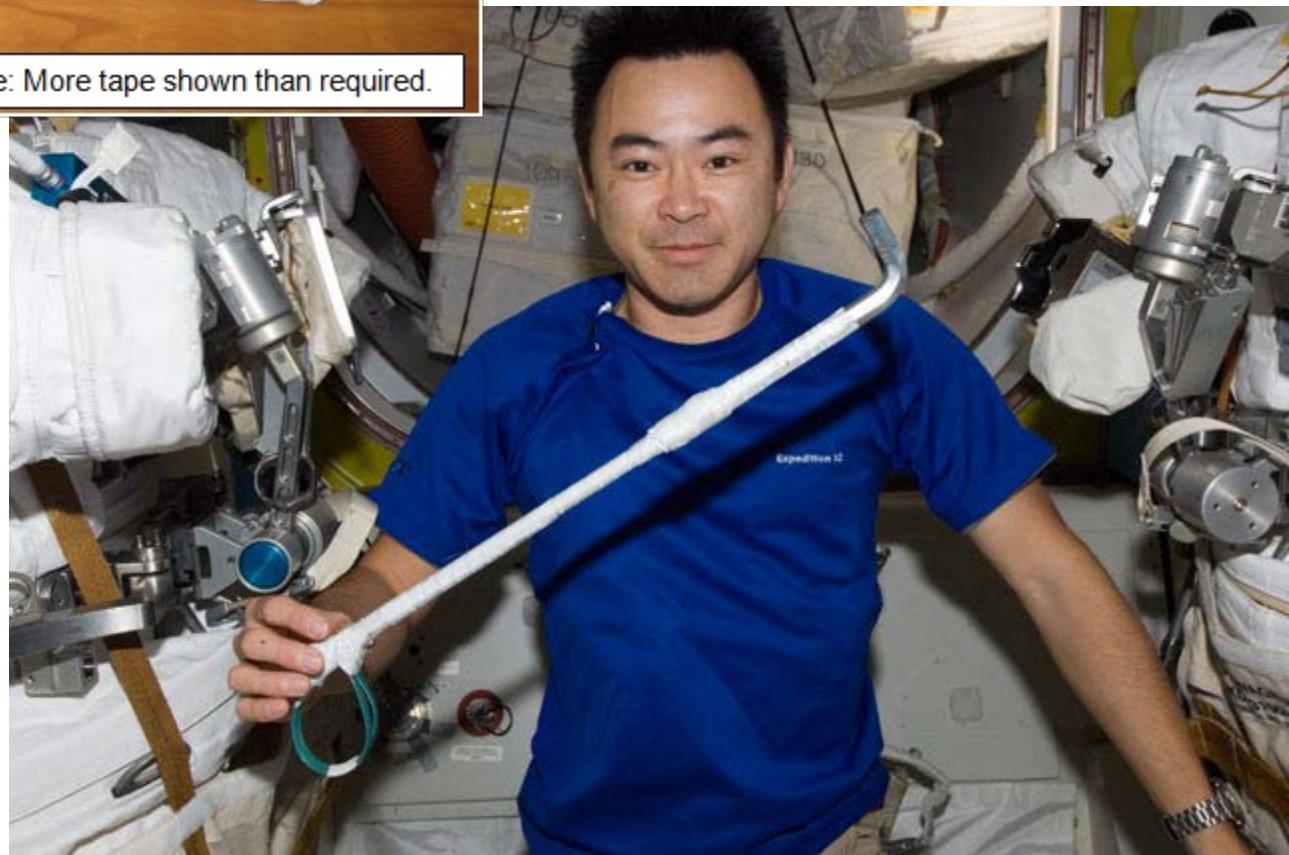
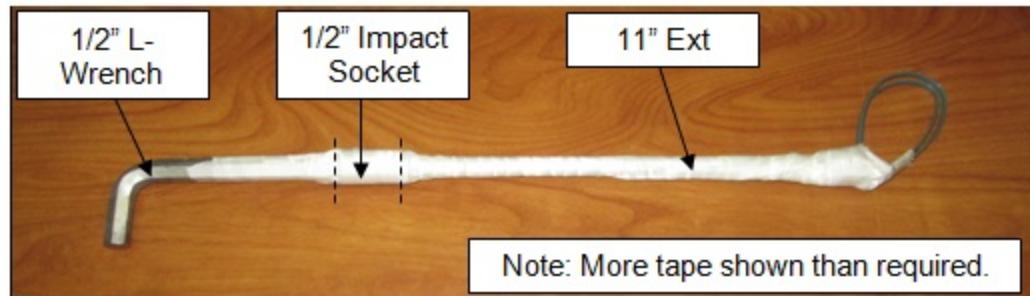
# Test Twice, Cut Once (2009/Inc 20)



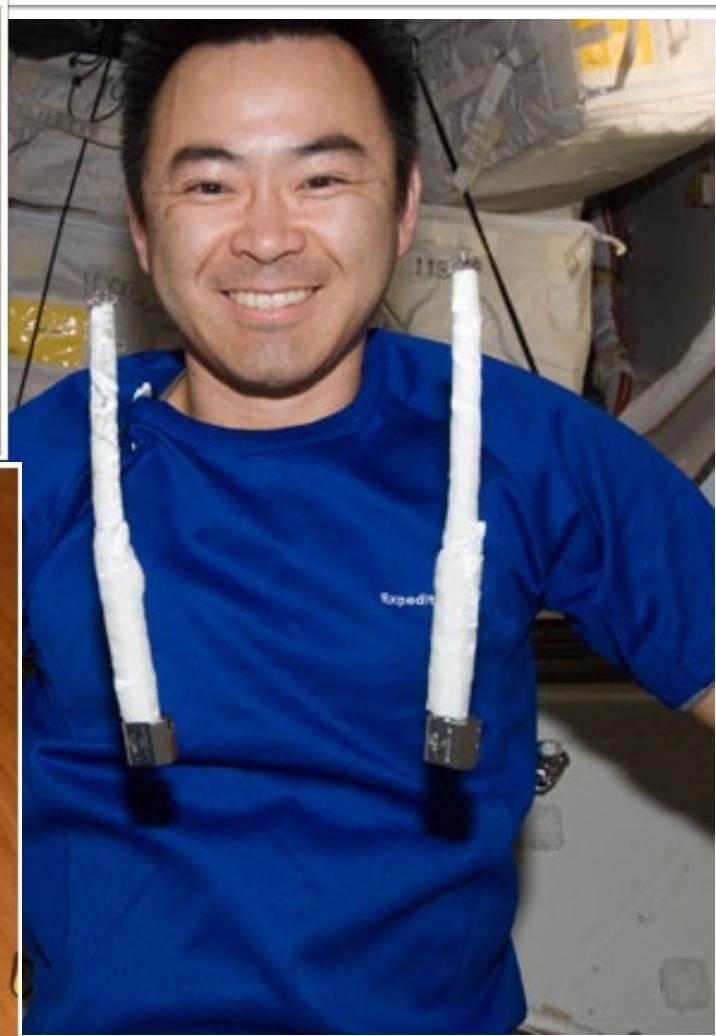
# Tethered ACME Bolt



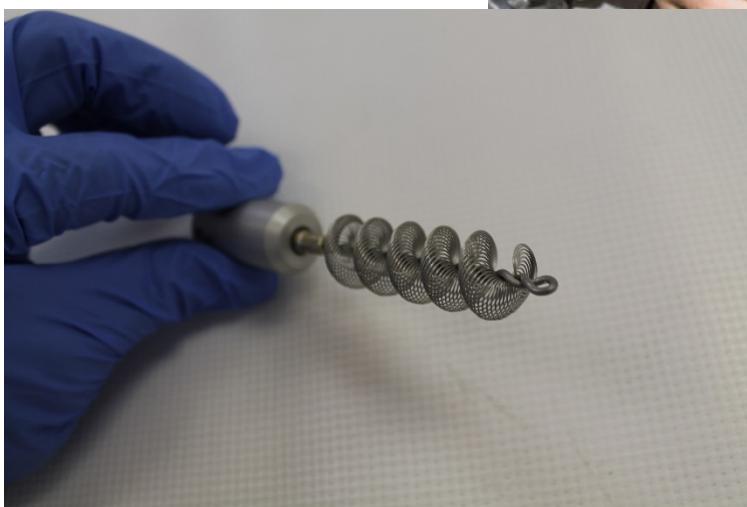
# ACME Bolt Interface Tool



# Tethered Chimney Sweeps



# Tethered Lube (tooth)Brush



# Take'm outside



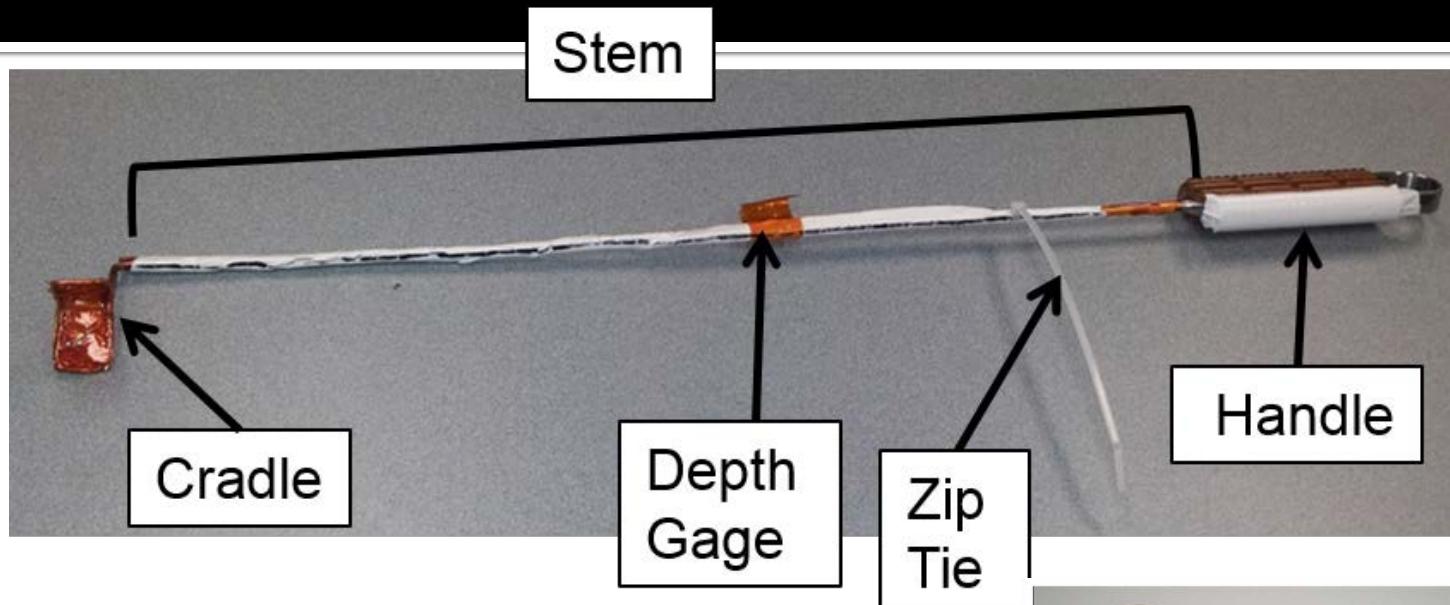
# LEE Lube



# LEE Lube



# Ballscrew Lubing Tool (BLT)



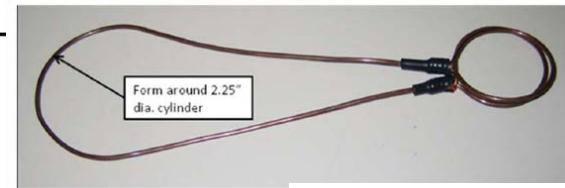
Space Grease Gun



ISS017E007453



Kapton Tape

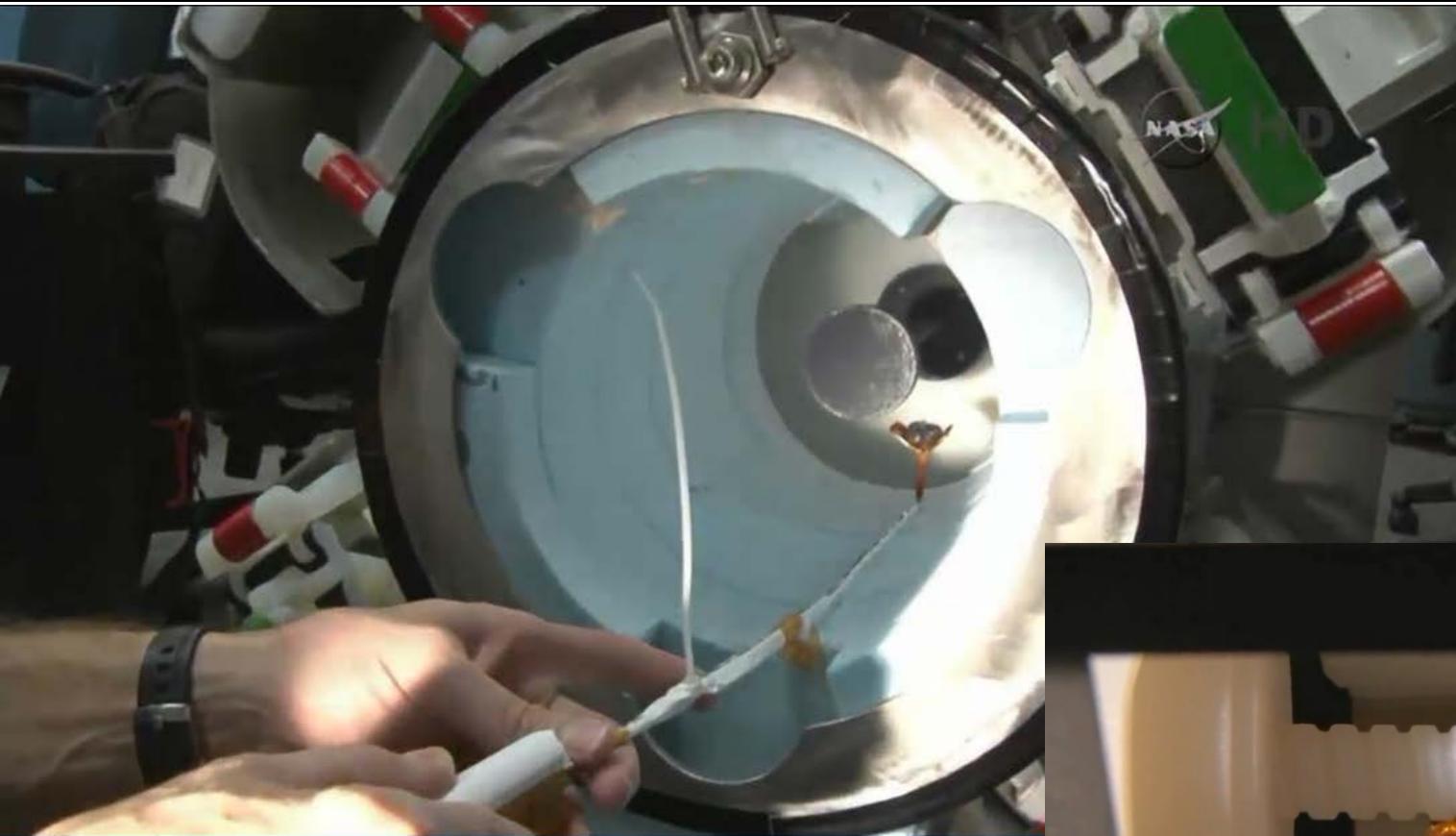


Wire ties

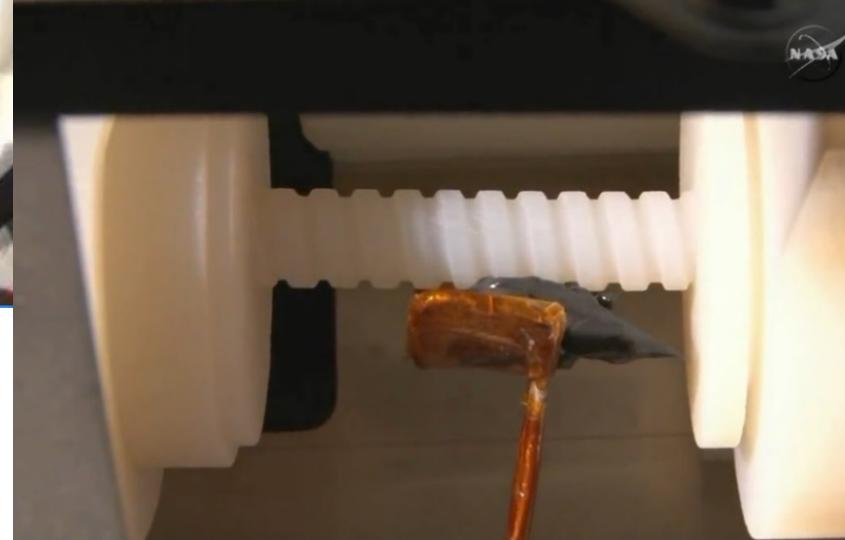


Zip Ties

# Ballscrew Lubing Tool (BLT)

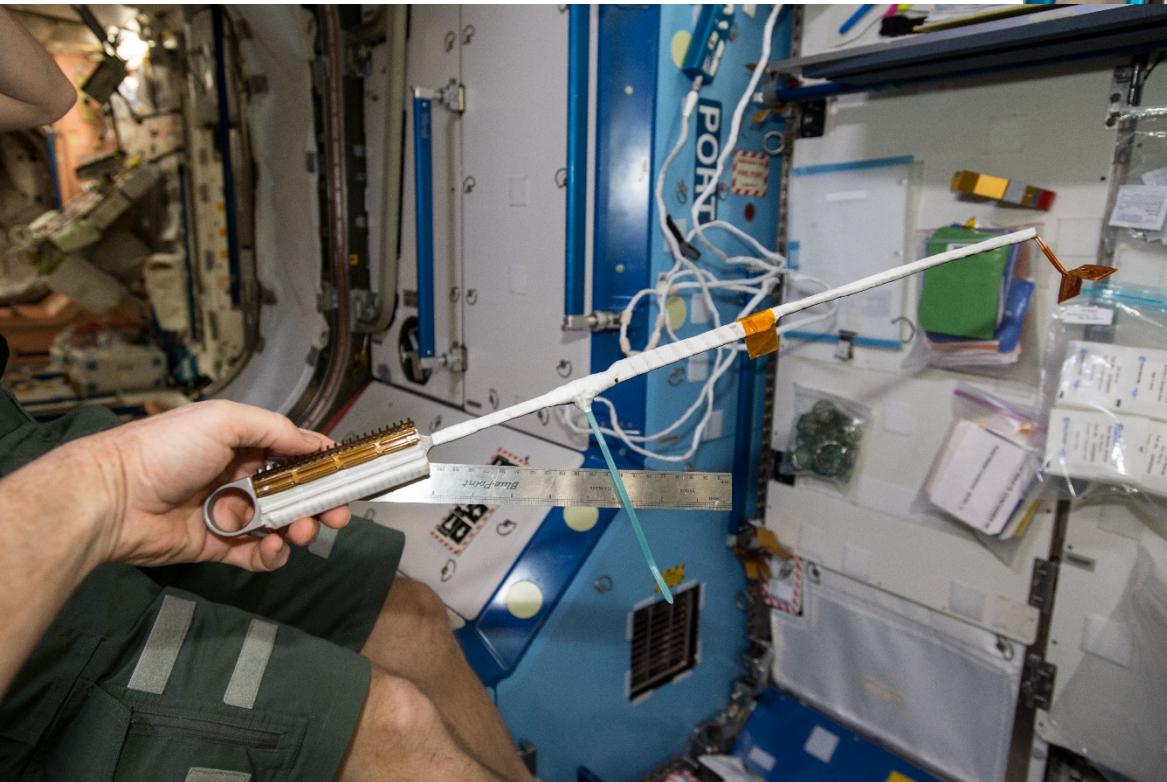


Training to use the BLT on ground  
mockups of the LEE

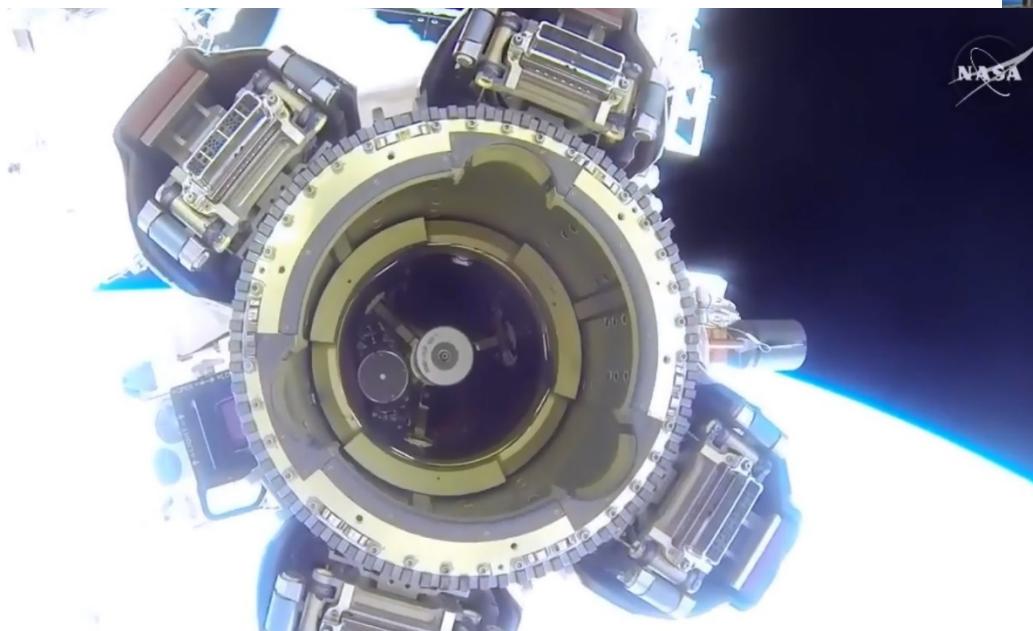
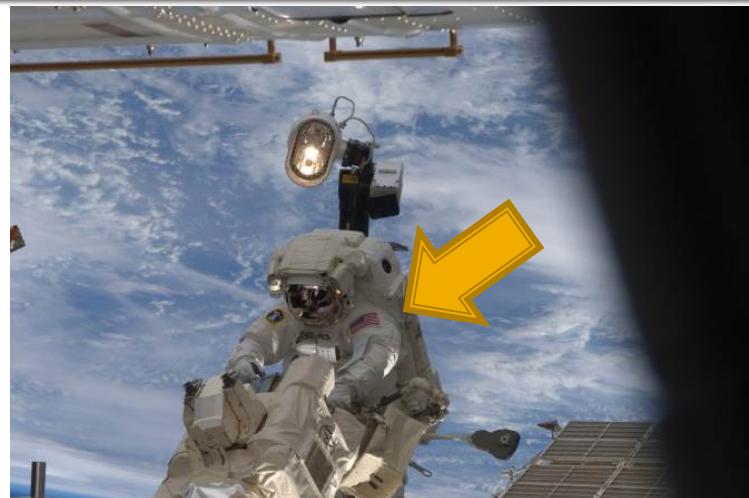


# BLT On Orbit

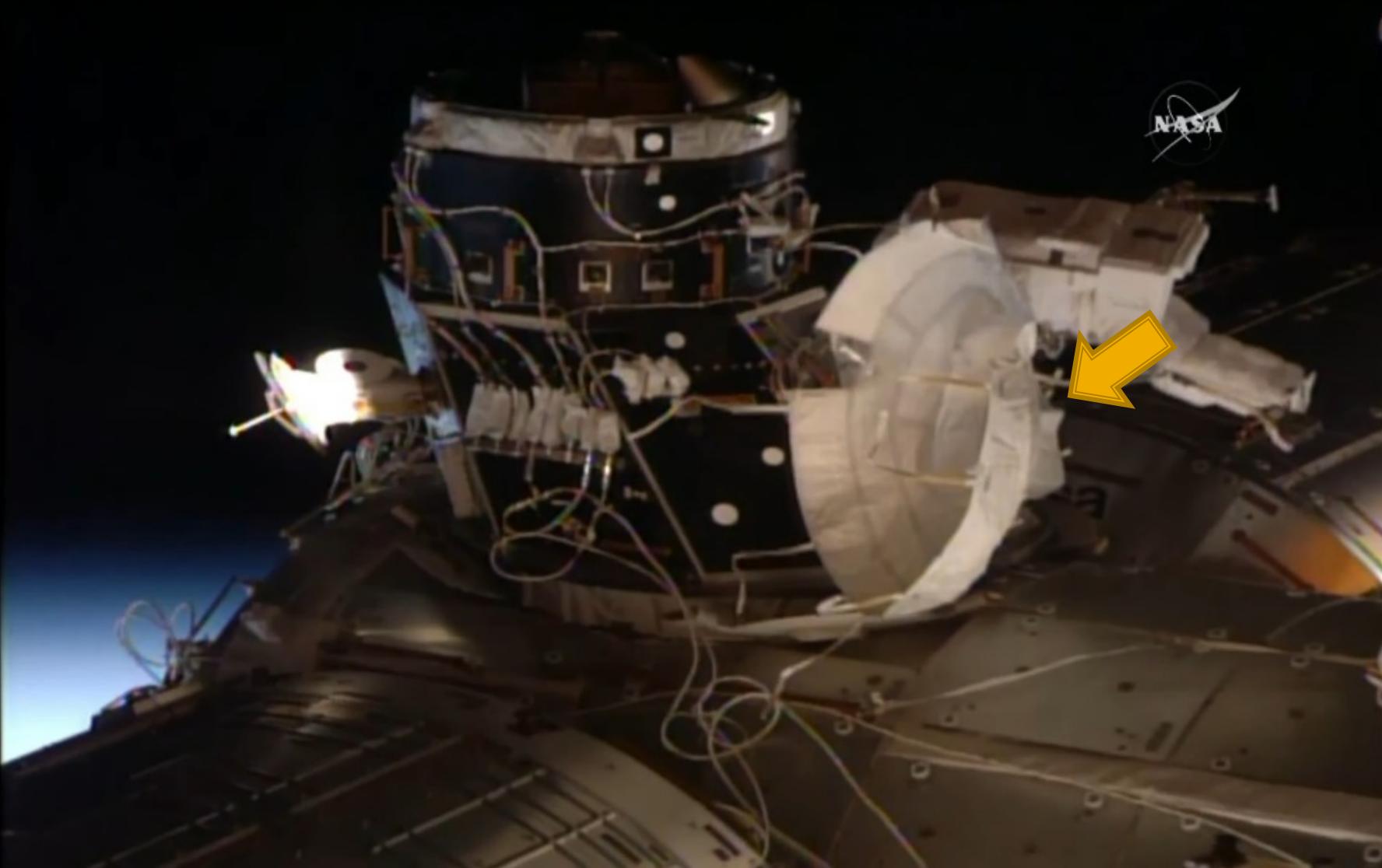
The as built BLT on orbit, looked almost exactly like the ground built unit



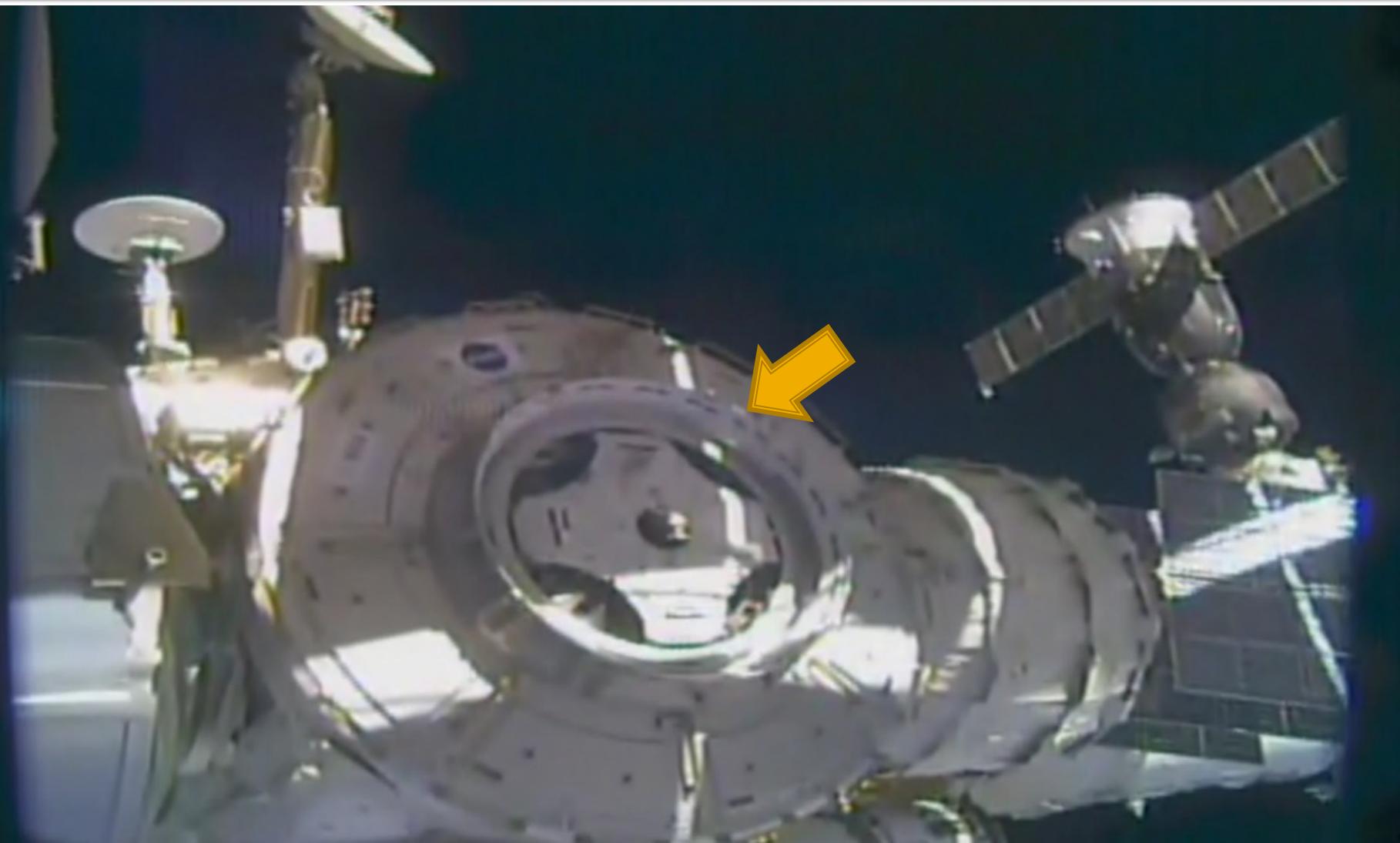
# BLT In Use



# US EVA 41 Lost Shield



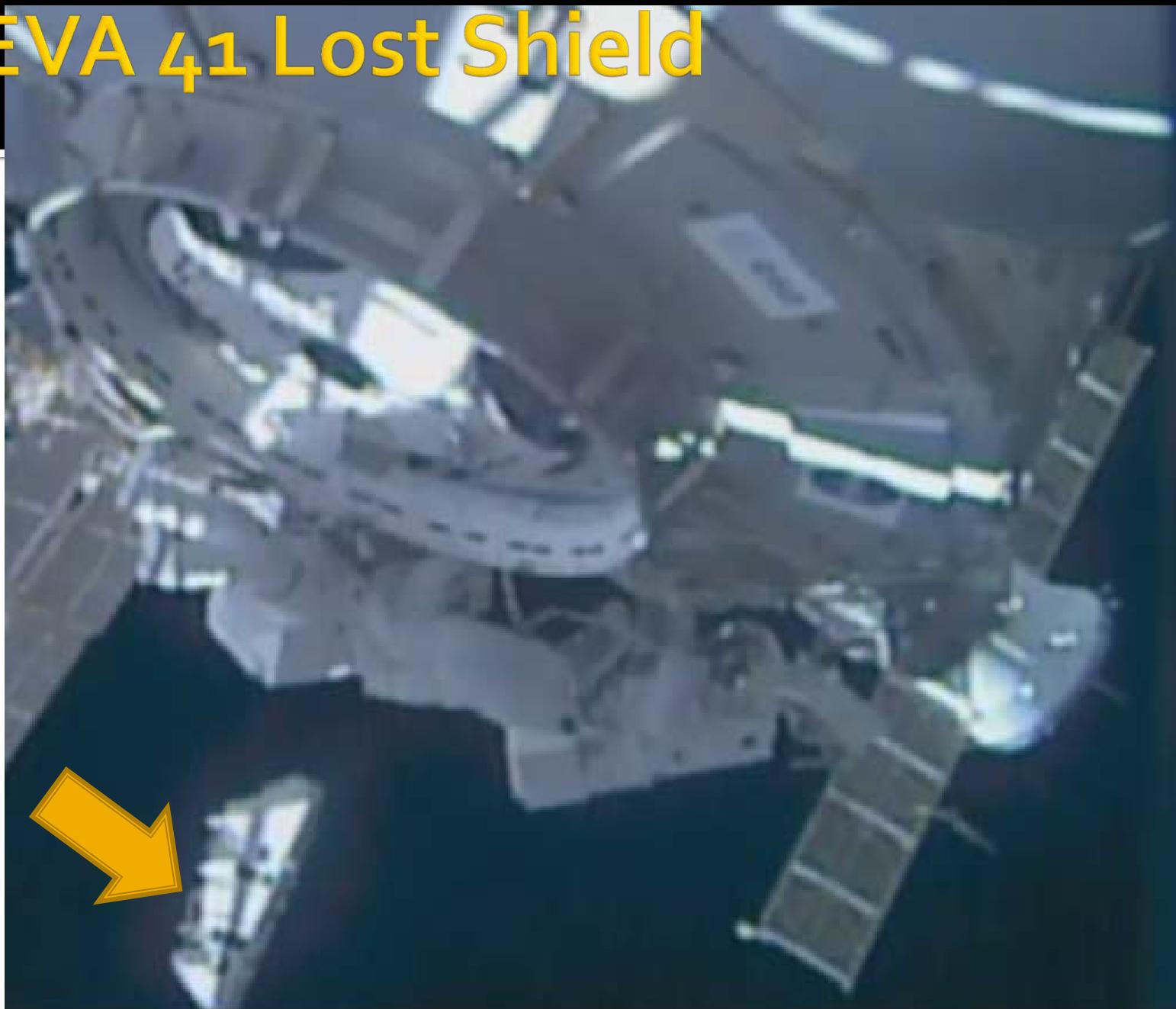
# US EVA 41 Lost Shield



# US EVA 41 Lost Shield



# US EVA 41 Lost Shield



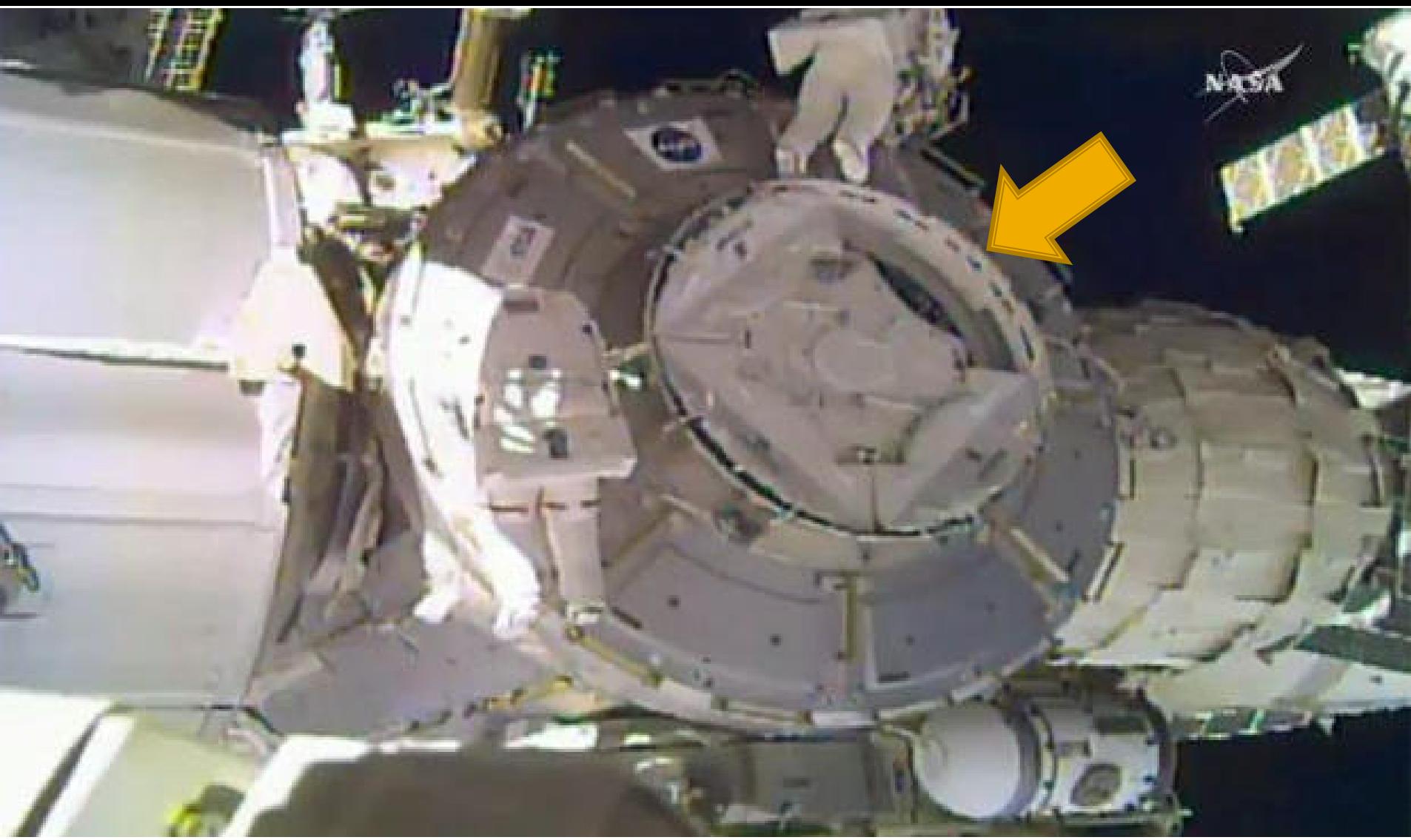
# US EVA 41 Lost Shield



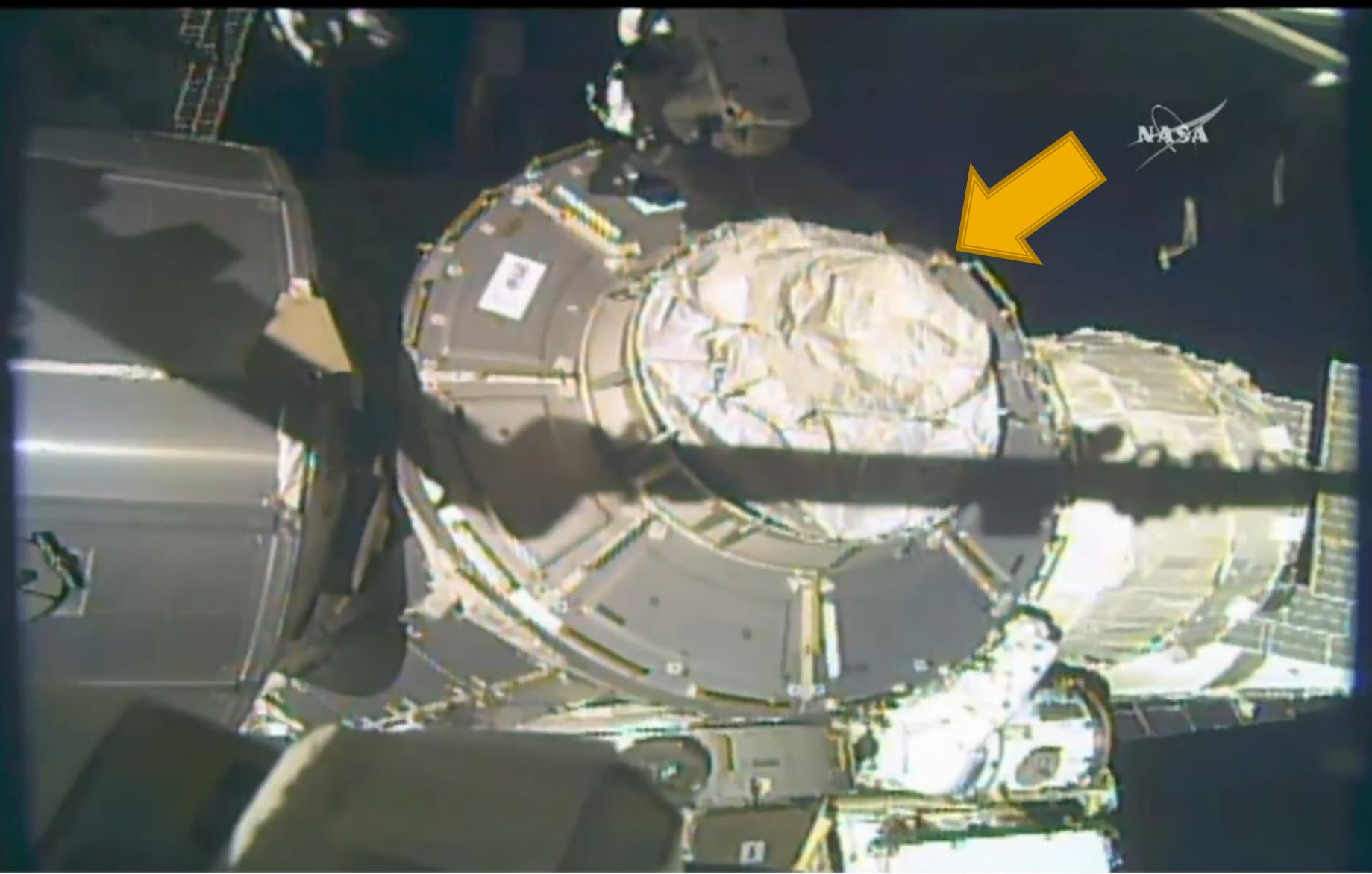
# US EVA 41 Lost Shield



# US EVA 41 Lost Shield



# US EVA 41 Lost Shield



# US EVA 41 Lost Shield

f t m

News / Nation & World / Science

## Spacewalkers lose piece of shielding, use MacGyver-like plan for patch instead



Spacewalking astronauts lost a piece of shielding needed for the International Space Station.

Whitson and Shane Kimbrough were installing the shielding over a vulnerable spot on the space station. (March 30, 2017) (Sign up for our free video newsletter here <http://bit.ly/2n6VKPR>)